

REMARKS

Claims 22 and 32 have been amended to clearly state that which is inherent in the reading of each of these claims. Since the patterned photoresist layer has been removed from the surface of the patterned second mask layer prior to etching of the noble metal layer through the patterned second mask layer, the noble metal layer is pattern etched while the entire surface of the second mask layer is exposed to the plasma. Further, after pattern etching of the barrier layer, any residue of the second mask layer as well as the first mask layer is removed in the final step of the method.

Claim Rejections Under 35 USC § 112

Claims 29 - 32 are rejected under 35 USC § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicants regard as the invention. In particular, the Examiner states that Claims 29 - 32 recite "said etchant gas", when etchant gases are referred to in more than one step in the independent claims from which Claims 29 - 32 depend.

Applicants intended the term "said etchant gas" to refer to the etchant gas which is used to generate the plasma used to etch the noble metal layer. Upon reviewing the presently pending claims in the application, applicants noticed an inconsistency in the claim language between Claims 29, 30, 31, and 32, and the claims from which they depend (Claims 1, 13, 14, and 22, respectively). Independent Claims 1, 13, 14, and 22 recite the claim language "consists essentially of" with respect to the etchant gas which is used to generate the plasma used to etch the noble metal layer. Applicants' Claims 29 - 32 (which were first presented in applicants' previously submitted Amendment "D") stated that the etchant gas "also contains an additive selected from the group consisting of HBr, BCl₃, SiCl₄ and mixtures thereof", which is inconsistent with the "consists essentially of" terminology used in the claims from which they depend. Applicants have therefore amended Claims 29 - 32 to be in independent form, so that

Claims 29 - 32 now recite that the etchant gas used to generate the plasma which is used to etch the noble metal layer “consists essentially of” the gases listed in the particular claim from which Claims 29 - 32 depend and also an additive gas selected from the group consisting of HBr, BCl₃, SiCl₄ and mixtures thereof.

In light of the amendments to Claims 29 - 32, applicants respectfully request withdrawal of the rejection of Claims 29 - 32 under 35 USC § 112, second paragraph.

Claim Rejections Under 35 USC § 102

Claims 1, 10, 11, and 13 - 16 are rejected under 35 USC § 102(e) as being anticipated by U.S. Patent No. 6,143,476, to Ye et al.

Applicants respectfully contend that their invention as claimed in amended Claim 1, and Claims 10 and 11 which depend therefrom; Claim 13; and amended Claim 14, and Claims 15 and 16 which depend therefrom are not anticipated by Ye et al.

The Ye et al. invention pertains to a method of patterning a semiconductor device feature where the patterned mask on the surface of a substrate to be etched is a high-temperature organic-based mask. This high-temperature, organic-based mask is used because it can be easily removed from the underlying substrate by exposure to an oxygen plasma. This concept teaches away from applicants' invention where the patterned mask or protective layer directly in contact with the surface of the noble metal substrate to be etched is an inorganic material.

The invention, as presently claimed in independent Claims 1, 13, 14, 19, 22, and 29, employs an essentially inorganic masking layer or an essentially inorganic protective layer directly on the surface of the noble metal substrate to be etched. There is no high-temperature, organic-based mask present on the surface of the noble metal substrate to be etched. Thus, the Ye et al. disclosure teaches away from applicants' invention as currently claimed. Applicants' claimed invention is not anticipated by the disclosure in the Ye et al. patent.

In more detail, the Ye et al. reference describes three possible paths by which the Ye et al. invention may be carried out. The first possibility is one in which the high-temperature organic-based mask is created by applying the high temperature, organic-based masking material directly over the substrate to be etched; applying an inorganic hard mask material over the organic-based masking material; applying a photoresist over the inorganic hardmask material; using the photoresist to pattern the hardmasking material; removing the photoresist; and using the patterned inorganic hardmask to pattern the high-temperature, organic-based masking material. The underlying substrate may be etched without removal of the residual inorganic hardmask, where the residual inorganic hardmask is completely removed, along with portions of the high-temperature, organic-based mask, during the etching process. In a second possible path, the inorganic hard mask may be removed prior to etching of the underlying substrate using the high-temperature, organic-based mask to pattern etch the underlying substrate. In a third possible path of the Ye et al. invention, the hard mask used to transfer a pattern to the underlying substrate is formed from a radiation sensitive high-temperature, organic-based masking material, which can be patterned by irradiation and development and used directly as the mask.

The concept in the Ye et al. reference is that a hard masking layer is typically a good dielectric, and that the presence of the residual hard masking layer decreases the gate speed of a field effects transistor, for example. Thus, it is necessary to be certain that the residual hard masking layer can be easily removed. (Col. 2, lines 61 - 65) The Ye et al. method provides for a high-temperature, organic-based mask to be used for pattern transfer to an underlying substrate. In a first embodiment, a multi-layered masking structure is used which includes a layer of photoresist overlying a layer of inorganic masking material, where the inorganic masking material overlies a layer of high-temperature organic-based masking material which is patterned and used to transfer a pattern to an underlying substrate. This multi-layered masking structure is described at Col. 3, lines 48 - 60. In a second embodiment, the high-temperature pattern-imaging layer which is used to pattern a high-temperature organic-based masking material

(which transfers the pattern to an underlying substrate) may also contain organic components. This multi-layered masking structure is described at Col. 4, lines 47 - 67, continuing at Col. 5, lines 1 - 8. When an inorganic hard masking material is used to pattern the high-temperature, organic-based mask, the inorganic hard masking material is designed to be removed prior to completion of etching of a substrate layer underlying the high-temperature, organic-based mask. Thus, it is always an organic-based mask layer residue which remains to be removed from the surface of an underlying substrate which has been pattern etched. (Col. 9, lines 41 - 47) The Ye et al. reference teaches away from the present invention by teaching that it is a disadvantage to have an inorganic material applied directly over a conductive material during patterning of the conductive material, as the inorganic hard masking layer is difficult to remove subsequently. (Col. 2, lines 42 - 67)

In the present Office Action, the Examiner argues that applicants' claims which remain rejected are written in open language with respect to the layered structure to be etched and therefore do not preclude a second mask layer which comprises an organic mask layer. Step a) of applicants' independent Claim 1 (from which Claims 10 and 11 depend) has been amended to recite that the substrate supports a series of layers which consist essentially of a barrier layer on the substrate, a noble metal layer on the barrier layer, a protective layer on the noble metal layer, a mask layer on the protective layer, and a patterned resist layer on the mask layer, where the protective layer and the mask layer consist essentially of inorganic materials. Step a) of applicants' independent Claim 14 (from which Claims 15 and 16 depend) has been amended to recite that the substrate supports a series of layers which consist essentially of a barrier layer on the substrate, a noble metal layer on the barrier layer, a protective layer on the noble metal layer, a mask layer on the protective layer, and a patterned resist layer on the mask layer, where the protective layer and the mask layer consist essentially of inorganic materials. Step a) of applicants' independent Claim 13 was amended, in applicants' previously submitted Amendment "D", to recite that the substrate supports a series of layers which consist essentially of a barrier

layer on the substrate, a noble metal layer on the barrier layer, an inorganic mask layer on the noble metal layer, and a patterned resist layer on the mask layer. The use of the terminology “consisting essentially of” with respect to the in film stack layers recited in independent Claims 1, 13, and 14 makes it clear that there is no organic-based masking layer in contact with the noble metal substrate which is being patterned in Claims 1, 13, and 14.

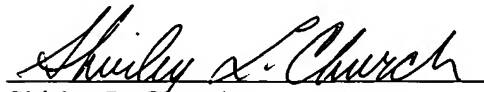
It is applicants’ contention that the amendments to independent Claims 1 and 14, made herein, and to independent Claim 13, made in applicants’ previously submitted Amendment “D”, clarify that there is no organic-based masking material in direct contact with the noble metal layer which is to be etched to form the RAM capacitor electrode.

The Ye et al. reference does not even suggest the specific film stack combinations and integrated processes which are taught by applicants. In fact, the Ye et al. reference teaches away from such film stack combinations and integrated processes. In light of the above distinctions and the amendments to independent Claims 1, 10, 13, and 14, applicants respectfully request withdrawal of the rejection of Claims 1, 10, 11, and 13 - 16 under 35 USC § 102(e), over Ye et al.

Applicants contend that the presently pending claims as amended are in condition for allowance, and the Examiner is respectfully requested to enter the requested amendments and to pass the application to allowance.

The Examiner is invited to contact applicants’ attorney with any questions or suggestions, at the telephone number provided below.

Respectfully submitted,

A handwritten signature in cursive script, reading "Shirley L. Church", written over a horizontal line.

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